

Application No. 10/081,518

AMENDMENTS TO THE CLAIMS

Claims 1-34 (canceled)

35. (currently amended) A rotational angle detecting device comprising:

detecting means for detecting a position of a target and outputting a detection signal according to the detected position;

a rotational member on which said target is provided so that the detection signal changes according to a rotation of the rotational member; and

angle calculating means for calculating a rotational angle of said rotational member based on the detection signal multiplied by a gain, said rotational angle detecting device further comprising:

means for detecting a maximum value and a minimum value of the detection signal multiplied by said gain;

means for calculating a difference between the detected maximum value and minimum value $[[:]$ ; and

gain correcting means for correcting said gain so that the calculated difference is equal to a preset reference difference.

36. (previously presented) The rotational angle detecting device as set forth in claim 35, further comprising:

means for calculating a ratio of said calculated difference

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to said reference difference; and

means for calculating a corrective gain by multiplying a preset reference gain by said calculated ratio, wherein

said gain correcting means corrects said gain to said corrective gain.

37. (original) The rotational angle detecting device as set forth in claim 35, wherein said target is provided on said rotational member so that a distance between said target and said detecting means changes according to a rotation.

38. (original) The rotational angle detecting device as set forth in claim 35, wherein said target is made of protrusions provided at substantially equal intervals in a circumferential direction of said rotational member.

39. (withdrawn) The rotational angle detecting device as set forth in claim 35, wherein said target is made of non-dent portions between dents formed at substantially equal intervals in a circumferential direction of said rotational member so as to create the non-dent portions.

40. (withdrawn) The rotational angle detecting device as set forth in claim 35, wherein said target is magnetized so that magnetic

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poles reverse at substantially equal intervals in a circumferential direction of said rotational member.

41. (withdrawn) The rotational angle detecting device as set forth in claim 35, wherein said target comprises a first inclining portion provided to incline in one direction on a circumferential surface of said rotational member, and a second inclining portion provided to incline in other direction on the circumferential surface of said rotational member.

42. (original) The rotational angle detecting device as set forth in claim 35, wherein said detecting means comprises first detecting means and second detecting means, juxtaposed in a direction of rotation of said rotational member, for outputting detection signals having a phase difference.

43. (previously presented) The rotational angle detecting device as set forth in claim 42, further comprising:

first judging means for judging whether or not each of the detection signals of said first detecting means and second detecting means is higher than a first threshold greater than a detection signal value obtained when detection signal waveforms of said first detecting means and second detecting means crossed each other;

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second judging means for judging whether or not each of the detection signals of said first detecting means and second detecting means is lower than a second threshold smaller than a detection signal value obtained when the detection signal waveforms of said first detecting means and second detecting means crossed each other; and

third judging means for judging whether or not the detection signal waveforms of said first detecting means and second detecting means cross each other,

wherein the maximum value and minimum value of said detection signal are detected based on results of judgments made by said first, second and third judging means.

44. (withdrawn) A torque detecting device, comprising:

said rotational angle detecting devices of claim 43, provided for each of a first rotating shaft and a second rotating shaft which are coaxially connected to each other; and

torque calculating means for calculating a torque applied to said first rotating shaft, based on a difference between rotational angles detected by said rotational angle detecting devices.

45. (withdrawn) A torque detecting device, comprising:

said rotational angle detecting devices of claim 43, provided for each of a first rotating shaft and a second rotating shaft

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which are coaxially connected to each other; and

torque calculating means for calculating a torque applied to said first rotating shaft, based on a difference between rotational angles detected by said rotational angle detecting devices; wherein

when both the first detecting means and both the second detecting means of said rotational angle detecting devices detected the maximum values, the maximum values are made valid, while when both the first detecting means and both the second detecting means detected the minimum values, the minimum values are made valid.

46. (withdrawn) The torque detecting device as set forth in claim 45, further comprising:

temperature detecting means for detecting temperature of said first detecting means and second detecting means;

storing means for storing a temperature detected by said temperature detecting means when the maximum value or the minimum value of each of the detection signals of said first detecting means and second detecting means was detected; and

means for calculating a difference between the temperature detected by said temperature detecting means and the temperature stored in said storing means and comparing the calculated difference with a predetermined value when said angle calculating means calculates a rotational angle,

wherein when the difference is greater than the predetermined

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value, the calculation of said angle calculating means is prohibited.

47. (withdrawn) A steering apparatus, comprising:

a first rotating shaft connected to a steering wheel;

a second rotating shaft connected coaxially to said first rotating shaft and connected to a steering mechanism;

said torque detecting device of claim 46, for detecting a steering torque applied to said first rotating shaft; and

an electric motor for assisting a rotation of said second rotating shaft, based on the steering torque.

48. (currently amended) A rotational angle detecting device comprising:

detecting means for detecting a position of a target and outputting a detection signal according to the detected position;

a rotational member on which said target is provided so that the detection signal changes according to a rotation of the rotational member; and

angle calculating means for calculating a rotational angle of said rotational member based on the detection signal multiplied by a gain, said rotational angle detecting device further comprising:

means for detecting a maximum value and a minimum value of said detection signal;

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means for calculating an average value of the detected maximum value and minimum value; and

~~off set~~ offset correcting means for correcting said detection signal so that the calculated average value is equal to a preset reference average value.

49. (original) The rotational angle detecting device as set forth in claim 48, further comprising means for calculating a difference between said calculated average value and said reference average value,

wherein said offset correcting means adds said difference to said detection signal value so that the calculated difference becomes zero.

Claims 50-72 (canceled)

73. (new) A rotational angle detecting device comprising:

a rotatable shaft being adapted to rotate about an axis;

a target having a plurality of magnetically discontinuous segments provided therein, the target being provided on the rotatable shaft;

a detector for detecting a change in a magnetic field during a rotation of the target, the detector outputting a detection signal;

a processing unit for receiving the detection signal and for

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determining a rotational angle of the rotatable shaft,

wherein the processing unit detects a maximum value and a minimum value of the received detection signal,

wherein the processing unit calculates a difference between the detected maximum value and minimum value and/or calculates an average value of the detected maximum value and minimum value, and

wherein the processing unit corrects a gain so that the difference between the detected maximum value and minimum value is equal to a preset reference difference and/or corrects an offset so that the calculated average value is equal to a preset reference average value.

74. (new) The rotational angle detecting device according to claim 73, wherein the gain represents a change in an output characteristic of the detector on the basis of an influence of temperature or time.

75. (new) The rotational angle detecting device according to claim 73, wherein the offset represents a supplementary gap formed between the detector and the target due to the rotation of the target about the axis.

76. (new) A method of determining a rotational angle, the method comprising:

detecting a position of a target and outputting a detection



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signal according to the detected position, the target being provided on a rotational member, the detection signal changing according to a rotation of the rotational member;

detecting a maximum value and a minimum value of the detection signal;

calculating a difference between the detected maximum value and the minimum value;

correcting a gain so that the calculated difference is equal to a preset reference difference; and

determining the rotational angle on the basis of the corrected gain and the detection signal.

77. (new) A method of determining a rotational angle, the method comprising:

detecting a position of a target and outputting a detection signal according to the detected position, the target being provided on a rotational member, the detection signal changing according to a rotation of the rotational member;

detecting a maximum value and a minimum value of the detection signal;

calculating an average value of the detected maximum value and the minimum value;

correcting an offset so that the calculated average value is equal to a preset reference average value; and

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determining the rotational angle on the basis of the corrected  
offset and the detection signal.